Unit 12

Pacific Coast Salmon

Introduction

Pacific salmon support important traditional commercial and recreational fisheries in Washington, Oregon, and California. Salmon are part of the culture and heritage of the Pacific Northwest; having been harvested by native Americans for millennia.

Pacific salmon are anadromous. They spawn in freshwater and migrate to the ocean where they may undergo extensive migrations. At maturity, they return to their home stream to spawn and complete their life cycle.

Table 12-1. Pacific Coast Salmon

Productivity in metric tons and status of fisheries resources

Species	Recent Average Yield (RAY)[1,2]	Current Potential Yield (CPY)	Long-Term Potential Yield (LTPY)	Fishery Utilization Level	Stock Level Relative to LTPY
Chinook	4,783	11,460	11,460	Over	Below
Coho	2,459	5,300	5,300	Over	Below
Pink	5,743	7,270	7,270	Full	Near
Sockeye	4,231	4,646	4,646	Full	Near
Chum	5,741	4,636	4,636	Full	Near
Total	22,957	33,312	33,312		

[1] Recent average is for 1992-94 except for pink salmon which is 1989-91-93 average.
[2] Recreational harvest was converted from numbers of fish to approximate weight using average weights of salmon caught in commercial fisheries from 1990-94: Chinook = 5.04 kg, coho = 2.48 kg, pink = 2.08 kg, sockeye = 2.60 kg, and chum = 4.59 kg.

Pacific salmon include five species: chinook, coho, sockeye, pink, and chum salmon. Chinook and coho salmon are harvested recreationally and commercially in the Pacific Ocean, Puget Sound, and in freshwater rivers on their spawning migrations. All recreational fisheries use hook-and-line gear. Commercial fisheries use a variety of gear depending on location: in the Pacific Ocean all harvest is by trolling; in Puget Sound, gillnets and purse seines are also used; gillnets are used almost exclusively in freshwater and estuaries. Pink, chum, and sockeye salmon are not harvested in significant numbers recreationally nor outside of Puget Sound, although there are recreational fisheries directed at these species in a few locations. The majority of harvest is by commercial gillnet and purse seine fisheries in Puget Sound and gillnet fisheries in estuaries. All species are also harvested by Native American tribes for subsistence and ceremonial purposes.

From 1992-94, the average annual commercial salmon catch (15,000 t) provided revenues averaging over $30 million at dockside. Recreational catches are more difficult to value since the recreational experience associated with the catch cannot be easily measured. If recreationally caught fish are valued at a conservative $20 per fish, the 1992-94 average catch of 850,000 fish would have been worth about $17 million annually.

The abundance of individual stocks of Pacific salmon, and the mixture of stocks contributing to fisheries fluctuate considerably. Consequently, landings fluctuate. For all species, there is excess fishing power and overcapitalization of the fishing fleets. While harvest rates in recent years have been held near, or below, levels that would produce the long-term potential yield, environmental conditions have resulted in poor production of chinook and coho salmon in general and some individual stocks of other species. Because of the depressed status of chinook and coho salmon, these two species are considered overexploited while the other species are considered fully exploited (Table 12.1).

Management Situation

The management of this resource is complex, involving many stocks originating from various rivers and jurisdictions. Ocean fisheries for chinook and coho salmon are managed under an FMP by the Pacific FMC with the cooperation of the states and tribal fishery agencies. Within Puget Sound and the Columbia River, fisheries for these two species are managed by the states and tribes. The other three species (pink, chum, and sockeye salmon) are managed primarily by the Pacific Salmon Commission (PSC), the state of Washington, and tribal fishery agencies.

Fishery impacts are managed using a variety of regulations. Ocean fisheries are managed primarily by gear restrictions, minimum size limits, and time and area closures; although harvest quotas have been placed on

individual fisheries in recent years. Fisheries managed by the PSC have used harvest quotas based on inseason abundance forecasts. Some commercial fisheries in the Columbia River have used inseason monitoring of cumulative impacts to sensitive stocks based on genetic analysis of the catch to close the fisheries.

Because Pacific salmon depend on freshwater habitat for reproduction and rearing areas and the quality of freshwater habitat is directly influenced by land management practices, salmon production is heavily influenced by entities not directly involved in the management of fisheries. Salmon management involves the cooperation of the U.S. Forest Service, Bureau of Land Management, Fish and Wildlife Service, Bureau of Reclamation, Army Corps of Engineers, Environmental Protection Agency, Bonneville Power Administration, state resource agencies, Indian tribes, municipal utility districts, agricultural water districts, private timber companies and landowners.

On September 12, 1994, in response to an increasing number of petitions to list various populations of Pacific salmon and anadromous trout as endangered species, NOAA Fisheries announced its intent to conduct comprehensive, coastwide status reviews of all species of Pacific salmon. These status reviews are in various stages of completion.

Resource Status

Chinook salmon

Chinook salmon are produced primarily by rivers and hatcheries in Puget Sound in Washington, the Columbia River, the Umpqua and Rogue Rivers in Oregon, and the Klamath and Sacramento Rivers in California. Chinook salmon stocks are named for the season in which they migrate from the ocean to freshwater to spawn, and include spring, summer, fall and winter runs. The proportion of chinook salmon production originating from hatcheries has been increasing.

Chinook salmon production tends to fluctuate considerably (Fig. 12-1) depending on habitat conditions in freshwater and on ocean productivity. In recent years, problems with freshwater habitat have been exacerbated by drought in many areas in the west, and ocean conditions have been generally unfavorable for chinook salmon since the late-1970s. This has resulted in historically low levels of a number of stocks and commercial and recreational catches. Currently, the Snake River spring/summer run has been listed as a threatened species, and the Snake River fall-run and the Sacramento River winter-run chinook salmon populations have been listed as endangered species by NOAA Fisheries. In addition, several other runs from all parts of the coast have failed to meet their escapement goals in recent years. Concern for the status of depressed stocks has led to increasingly restrictive ocean fishing seasons in recent years.

Pacific Coast Chinook Commercial Landings
(Number of Fish)

1993	608,000
1994	463,000

Pacific Coast Chinook Recreational Landings
(Number of Fish)

1993	315,000
1994	452,000

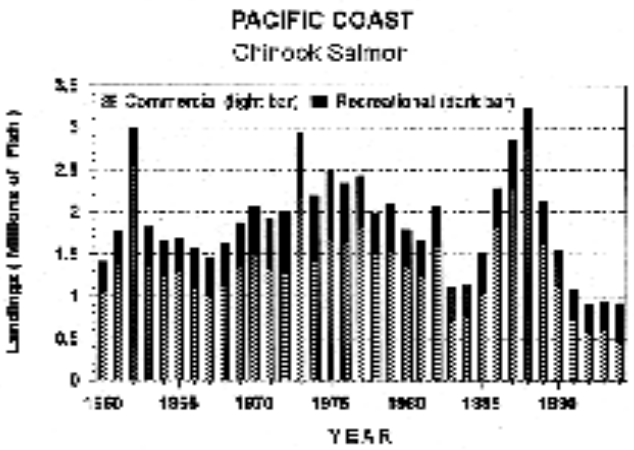


Fig. 12-1. Chinook salmon landings from Washington-Oregon-California region.

Coho Salmon

Coho salmon are produced primarily by rivers and hatcheries in Puget Sound in Washington, hatcheries in the Columbia River and coastal rivers and hatcheries in Oregon and California. Hatcheries play a larger role in the production of coho salmon than in the case of chinook salmon, in some areas accounting for over 80% of the catch. Recent reductions in landings have resulted from record low abundances of several stocks of coho salmon including Oregon coast and Columbia River hatchery stocks Fig. 12-2). To protect the spawning escapement of these stocks and to provide fish for the legally-mandated tribal

allocation, severe restrictions were placed on ocean fisheries in 1993 and 1994. In May 1994, retention of coho salmon was prohibited in all ocean fisheries.

Pacific Coast Coho Commercial Landings
(Number of Fish)

1993	331,000
1994	532,000

Pacific Coast Coho Recreational Landings
(Number of Fish)

1993	430,000
1994	550,000

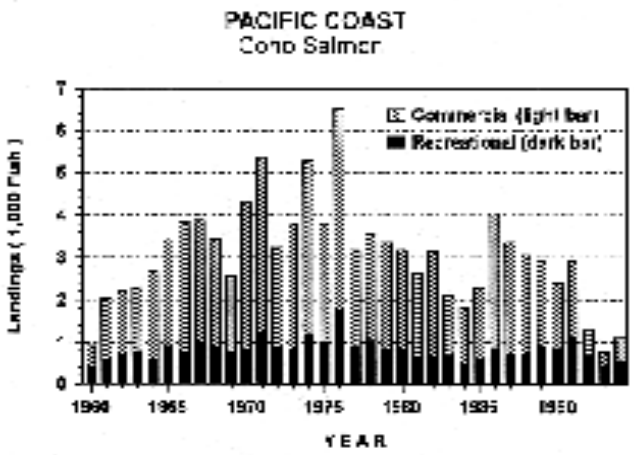


Fig. 12-2. Coho salmon landings from Washington-Oregon-California region.

Pacific Coast Sockeye Landings
(Number of Fish)

1993	2,426,000
1994	1,861,000

Sockeye, Pink and Chum Salmon

Pink and chum salmon originate primarily from tributaries of Puget Sound, Washington. Chum salmon are also produced, in limited numbers, in the Columbia River and coastal streams as far south as central Oregon. Sockeye salmon originate from river systems that contain lakes. They are produced in a few rivers in Puget Sound and in limited numbers in a few coastal rivers on the Olympic Peninsula and in the upper Columbia and Snake River basins. The majority of the harvest of these species is caught commercially in the Puget Sound region of Washington. Much of the U.S. harvest of sockeye and pink salmon originates from the Fraser River in Canada. Though Fraser River runs have been large in recent years, the U.S. catch has been limited under the Pacific Salmon Commission. Historical landings of the species are shown in Figs. 12-3 and 12-4.

Recreational Fisheries

Pacific salmon support valuable recreational fisheries in saltwater, freshwater, and in estuaries. Recreational landings of chinook salmon have averaged about 350,000 fish annually for the period 1992-94. During the same period recreational landings of coho salmon have averaged about 460,000 salmon from hatchery and natural production combined. These represent substantial reductions from recreational landings in the recent past, especially for coho salmon which had recreational landings averaging 864,000 salmon in the period 1990-92.

These reduced landings reflect lower abundance of these two species. Restrictive fishing seasons to protect depressed stocks of coho salmon and chinook salmon stocks listed under the Endangered Species Act have reduced the overall harvest of chinook and coho salmon. The depressed status of chinook and coho stocks has not been reflected in lower angler success rates in recreational fisheries. More severe reductions in commercial fisheries have largely compensated for reduced abundance by increasing the availability of chinook and coho salmon to recreational anglers.

Recreational landings for sockeye, pink, and chum salmon combined have consistently been under 100,000 fish, and have averaged about 80,000 fish. Recreational landings of these species are much lower than recreational catches of chinook and coho salmon while commercial landings are substantially greater. The reason for this discrepancy lies in the life histories and migration patterns of the individual species. Sockeye, pink and chum salmon migrate far offshore into the central North Pacific Ocean and the Gulf of Alaska. Consequently they are only available to recreational fisheries briefly during their spawning migration. In addition, pink and chum salmon spawn and die shortly after entering freshwater as adults. By the time they reach terminal areas where recreational fisheries are located, they have undergone physiological changes in preparation for spawning. Consequently, their flesh is of poorer quality, and they are not as highly prized as chinook, coho and sockeye salmon. While the recreational fisheries for sockeye, pink, and chum salmon are substantially smaller than recreational fisheries for chinook and coho salmon, they are still important.

Landings

For the period from 1992-94, the chinook salmon harvest from natural and hatchery production combined averaged about 550,000 fish. In the same period, commercial catch of coho salmon has averaged about 500,000 salmon This is a substantial reduction from the 1990-92 average commercial landings of 815,000 chinook salmon and 2,180,000 coho salmon, and as with recreational landings, reflects restrictions placed on ocean fisheries in 1993 and 1994 to protect the spawning escapement of depressed and listed stocks.

Sockeye, pink and chum salmon have not suffered the same recent declines as chinook and coho salmon. Trends in the recent landings have generally been stable or increasing. Recent average annual catches of these species were roughly 1.6 million sockeye salmon (1992-94), 1.3 million chum salmon (1992-94), and 2.6 million pink salmon (1989, 91, 93).

Issues and Progress

Balancing Competing Users

The decline in chinook and coho salmon abundance has forced severe reductions and closures of ocean fisheries in recent years. These reductions, in some cases, follow earlier reductions legally mandated to allocate salmon to inside fisheries for harvest by Native American tribes. These ocean fisheries cannot redirect their effort to take advantage of abundant sockeye, pink , and chum salmon stocks, because the ocean distribution of these species keeps them outside the range of coastal fisheries. With the prospect of even further restrictions that may be required to protect threatened and endangered species, the future viability of these fisheries is in doubt.

Hatchery versus Wild

The use of hatcheries to mitigate habitat loss and to enhance fisheries, especially for chinook and coho salmon, has raised concerns about the interactions of hatchery and natural fish. While hatchery fish can supplement natural production, they can also compete with naturally produced fish. In areas where fisheries are managed for hatchery production, harvest rates may be higher than the natural stocks can sustain. In addition, some hatchery fish fail to return to the hatchery and would attempt to spawn in the wild with native fish. Hatchery fish are often of non-native origin, and the introgression of non-native genes into natural populations can compromise the genetic integrity of the native stocks and decrease their productivity. To address these concerns, NOAA Fisheries has drafted an interim policy on artificial propagation in the listing and recovery of Pacific salmon under the ESA.

Pacific Coast Chum Landings
(Number of Fish)

1993	957,000
1994	1,323,000

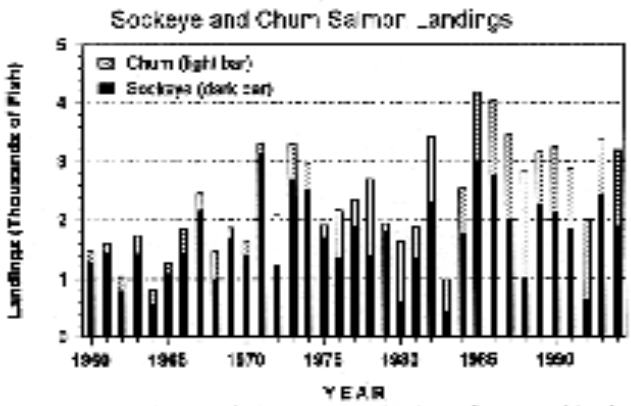


Fig. 12-3 Sockeye and chum salmon landings from combined Washington, Oregon, and California region.

Bycatch and Multispecies Interactions

Some salmon, primarily chinook, are caught incidentally in the Pacific whiting fishery. While the numbers are small, this is a sensitive issue when directed salmon fisheries have been increasingly restricted. Interactions with marine mammals have also become a sensitive issue as populations of California sea lions have increased. Predation by sea lions tends to be localized, but is also highly visible.

Transboundary Stocks and Jurisdiction

Because salmon migrate long distances, they are subject to interception by fisheries distant from their region of origin. Issues of allocation have never been easy to resolve and have been addressed in a variety of forums. The

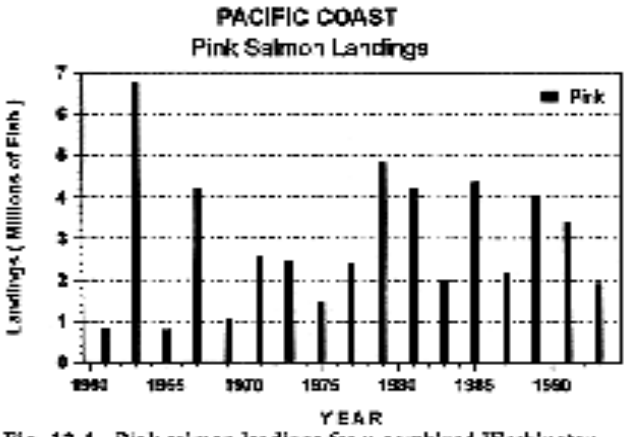
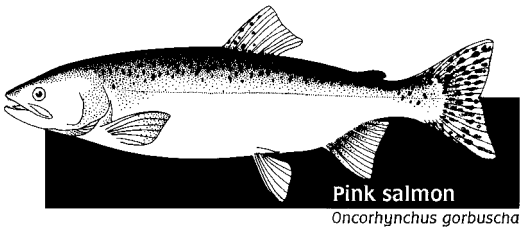


Fig. 12-4. Pink salmon landings from combined Washington, Oregon, and California region.

Pacific Coast Pink Landings
(Number of Fish)

1989	4,000,000
1991	3,373,000
1994	1,894,000

Pacific Salmon Commission has been set up to address the allocation of salmon between the U.S. and Canada. In 1994, a breakdown of the negotiations led to aggressive harvesting that compounded forecasting errors and nearly destroyed one of the most productive runs of sockeye salmon from the Fraser River in British Columbia. Much of the annual process of managing ocean salmon fisheries by the Pacific FMC is concerned with the allocation of fish between ocean and inside fisheries, commercial and recreational fisheries, and tribal and non-tribal fisheries. The allocation of salmon between Native American tribes and non-tribal users continues to be defined in federal courts.



Ecosystem Considerations

The abundance and harvest of coho salmon reached a peak in 1976, and has declined since then. Chinook salmon abundance has also generally declined since the mid-1970s, although there was a brief increase in chinook salmon abundance in the late-1980s. This decline has affected both hatchery and natural stocks, and seems to indicate a decline in ocean survival. This decline is coincident with a change in the oceanographic regime off the west coast that occurred around 1978. Since then, the coastal waters off California, Oregon, and Washington, where many chinook and coho salmon stocks rear, have been warmer and less productive than they were in the period from roughly 1950-78. This decline in ocean productivity off the Pacific coast appears to be linked to increased productivity in the Gulf of Alaska. Sockeye, pink and chum salmon, which migrate further offshore than chinook and coho salmon, have been relatively stable or increasing during the same period that chinook and coho salmon have declined.

Because Pacific salmon depend on freshwater habitat for spawning and juvenile rearing, they are particularly vulnerable to habitat degradation caused by human impacts. Throughout their range, their habitat has been degraded by logging, agriculture, grazing, and urbanization. Water development for hydropower, irrigation, and municipal and domestic uses directly competes with salmon for the freshwater on which they depend. As the human population in the western U.S. continues to increase, so will the pressures on salmon habitat. The fact that we still have salmon in harvestable quantities is a tribute to the resilience of these fish. ❑